REMARKS/ARGUMENTS

Claims 1-30 are pending in the application. Claims 1, 9, 19, 23, and 29 are in independent form. All of the claims were rejected based on various reference combinations except claims 18, 21, 26, and 28 were objected to as depending from rejected base claims but would be allowable if re-written in independent form. The claim rejections are addressed in the following sections in correspondence with the Examiner's rejections in the Action.

Claims 1, 5, and 6

The Examiner rejected claims 1, 5, and 6 as being anticipated under Section 102 based on U.S. Pat. No. 4,698,236 to Kellogg ("Kellogg"). The Examiner asserted that Kellogg teaches all of the claim limitations of claim 1 including the act of "forming the ions into a non-Gaussian, shaped ion beam having at a target plane an average current density lower than that of a similar beam without shaping." Contrary to the Examiner's contention, Kellogg does not teach this limitation because it does not teach providing a shaped beam with a relatively low current density. However, in order to more clearly distinguish claim 1 from Kellogg, Applicant's have amended the element to now recite: " forming the ions into a non-Gaussian, shaped ion beam having a current density that is uniform and sufficiently low to reduce overmilling." This is not taught or even alluded to by Kellogg.

As cited by the Examiner, Kellogg states: "[a]s used in this application, "focused beams" are beams that have been focused to a shaped, relatively broad (e.g., for ion beams, 5ų to 10ų) beam with high resolution at the beam edge, as well as Gaussian beams focused to a small spot."

(Kellogg, col. 3, ll. 59-62). This is the only place where Kellogg even references—let alone describes--a "shaped" beam. Kellogg nowhere defines (either expressly or implicitly) what it means by "shaped" beam, and it doesn't show or describe how it makes the beam or what type of shaped beam is required or desired. It does not even mention that the current density should be uniform let alone how to achieve such a beam. This is consistent with the fact that Kellogg is not concerned with the beam's shape or whether it has a sufficiently <u>low</u> current density; rather, Kellogg desires a high current density (in direct contrast to Applicant's claim 1) because a primary purpose of Kellogg is to provide faster gas deposition using a sufficiently high current density beam in cooperation with a pressurized gas delivery system to facilitate rapid gas absorption in order to avoid gas depletion with its high energy beams. (See, e.g., Kellogg at col. 4, l. 25 to col. 5, l. 5 and col. 8, ll. 21-25).

In contrast, Applicant's solution to the over-depletion problem for embodiments as recited in claim 1 is to provide shaped beams having relatively low and uniform current densities but with sufficiently high overall current, given their increased areas. The uniform nature of the beam's current density is important because it allows for target surfaces to be uniformly etched or deposited by stepping such beams over their surface. Accordingly, Kellogg fails to teach or disclose the sufficiently low and uniform current density limitation and thus does not anticipate claim 1 or claims 5 and 6, which also include this limitation.

<u>Claims 2-4</u>

Claims 2-4 were rejected as being obvious over Kellogg in view of Applicant's own disclosure. Claim 2 is amended to now recite: "<u>with a first lens, forming an image of the ion</u>

source onto a second lens; passing the ions through an aperture; and with the second lens, forming an image of the aperture onto the target." Applicant's "background" section teaches forming an image of an aperture onto a target in lithography applications, but neither it, nor Kellogg teach or disclose using first and second lenses in cooperation with an aperture as recited in the claim to achieve a beam with a relatively low and uniform current density. Again, Kellogg mentions the use of a shaped beam, but it doesn't at all mention a beam with a uniform current density and it arguably teaches away from a beam with a relatively low current density since it is concerned with a beam having sufficiently high energy and in particular a high current density. In fact, none f the cited references, alone or in combination teach or suggest these features and thus, claim 2 is not obvious in view of Kellogg and Applicant's disclosure.

Claim 3 recites "strongly underfocusing" the beam to create a beam with a uniform current density at the target surface. In Applicant's disclosure, the portion of the background referenced by the Examiner relating to underfocusing states: "Another solution is to use a weakly defocused ion beam system that produces a broader, lower current density beam. Such beams cannot, however, produce the sharp edges and high resolution required in modern applications." (page 4, ll. 14-22). Thus, it speaks of weak defocusing, and it says nothing of defocusing in cooperation with the beam passing through an aperture. Claim 3, on the other hand, recites the use of strong underfocusing of a beam passed though an aperture, which results in a low current density beam with sharp edges. Kellogg says nothing about any of this and the cited part of Applicant's disclosure actually teaches away from it. Therefore, claim 3 is not made obvious by Kellogg and Applicant's disclosure.

For similar reasons as discussed above, the high current, relatively low current density shaped beam of claim 4 is also not obvious over Kellogg and Applicant's disclosure.

Claim 7

Claim 7 is rejected as being obvious over Kellogg in view of Jones (U.S. Pat. No. 5,126,287).

In addition to the limitations in its base claim 1, dependent claim 7 further ads the use of placing a straight edge in the path of the beam near the beam's center to create a shaped beam with a sharp edge at the target. The Examiner contends that Jones teaches the use of a straight edge in this manner. The Examiner cites col. 5, ll. 19-34, which in pertinent part states: "A point-shaped (pyramid or conical) emitter is formed by using a square or circular-shaped aperture and a knife-shaped emitter is formed using an elongated aperture." (col. 5, ll. 24-28). From this language, Jones clearly doesn't teach this limitation. It simply teaches the use of an elongated aperture for making a knife-shaped emitter. Unlike with Applicant's teachings, the aperture 18 of Jones is actually formed as part of the target sample itself. It is used as a form to create the field emitter within its base. Thus, unlike with claim 7, the straight edges of the elongated aperture would not be aligned near the beam center for optimal construction. Rather, with a conventional gaussian shaped beam (Jones does not specifically speak of its beam), the edges would preferably be symmetrically aligned about the beam center to form a properly aligned, symmetrical emitter. In contrast, claim 7 recites placing a straight edge near the beam center. In fact, as a result of increased aberrations at the periphery of the beam, the closer the straight edge is aligned to the beam center, the sharper the beam edge will be at the target surface, which is in direct opposition

to Jones. Accordingly, Jones does not teach or suggest this limitation and thus, claim 7 is not obvious in view of the cited references.

Claim 8

Claim 8 was rejected as being obvious over Kellogg in view of Corbin (U.S. Pat. No. 5,973,295). Applicant does not contest that Corbin discloses the deposition of a non-conductive or a conductive material. However, because claim 8 depends from claim 1 and thereby includes all of its limitations, it is not obvious over the cited combination for the reasons set forth above with regard to Kellogg.

Claims 9-12

Claims 9-12 were rejected as being obvious over Kellogg in view of Ohnishi (5,120,925). Independent claim 9 is amended to now recite: "an ion beam column . . . producing a non-Gaussian, shaped ion beam having a current density that is substantially uniform at the target." Neither Kellogg nor Ohnishi, alone or in combination, teach this limitation. As discussed above, Kellogg merely alludes to a "shaped" beam, but it says nothing about it let alone whether it has a uniform current density. Accordingly, the cited references fail to teach this feature and as such fail to establish a prima facie case of obviousness against claim 9, as well as claims 10-12, which depend from claim 9.

Claim 13

Claim 13 was rejected as being obvious over Kellogg in view of Corbin and Ohnishi. Claim 13 ultimately depends from claim 9 and thus includes all of its limitations. Thus, because claim 9 is not obvious as discussed above, so to claim 13 is also not obvious.

Claim 14

Claim 14 is rejected as being obvious over Kellogg in view of Ohnishi and Jones. Because claim 14 depends from claim 9, it includes all of its limitations and thus is not obvious over a combination that includes Kellogg for the reasons discussed above. In addition, claim 14 further recites a "straight edge positioned in the path of the beam near its center." Jones is used to teach this feature, but as discussed above, Jones actually does not disclose it and in fact teaches away from it. Accordingly, claim 14 is clearly not obvious in view of Kellogg, Jones, and Ohnishi.

Claim 15

Claim 15 is rejected as being obvious over Kellogg, Ohnishi, and the Applicant's disclosure. Because claim 15 depends from claim 9, it includes its limitations and for that reason alone cannot be obvious over the cited reference combination with Kellogg. In addition, claim 15 includes the added limitation of focusing "the ion beam sufficiently beyond the target to provide a shaped ion beam of uniform current density at the target." As discussed above, this defocusing feature is not taught in the Applicant's background disclosure especially as recited in claim 15 to achieve a beam with a uniform current density at the target.

Claim 16

Claim 16 was not specifically addressed in the Action, but for the reasons set forth above regarding claim 9 (which is the independent base claim for claim 16), claim 16 is not obvious in view of any combination including Kellogg.

Claim 17

Claim 17 is rejected as being obvious over Kellogg in view of Ohnishi and Applicant's

disclosure. Claim 17 depends from claim 15, which depends from claim 9. Thus, for the reasons set forth as to why claims 9 and 15 are not obvious, so to, claim 17 is not obvious since it includes all of their limitations. In addition, claim 17 recites the use of an ion column with an aperture having a straight edge for producing a beam at the target with a sharp edge. None of the cited references including Ohnishi and Applicant's own background disclosure teach such an aperture—especially as it is used in combination within the other recited limitations. (Jones teaches an aperture with a straight edge, but its aperture is not part of an ion column and instead is part of the target itself.) Therefore, claim 17 is not obvious over the cited references.

Claims 19, 20, 22, 23 and 29

Claims 19, 20, 22, 23 and 29 are rejected as being obvious over Ohnishi in view of Applicant's background disclosure.

Claims 19, 20, and 22 each include the first/second lens and aperture limitations as recited in claim 2. As discussed therein, the lenses are configured to form an image of the aperture at the target and at the same time result with a beam at the target having a substantially uniform current density. Ohnishi teaches first and second lenses (condenser and object lenses) and an aperture, but it does not at all teach configuring them in Applicant's described way to achieve a shaped beam—let alone a shaped beam having uniform current density at the target.. Accordingly, claims 19, 20, and 22 are not obvious over the cited references.

Claims 23 and 29 each include limitations reciting defocusing (in particular, over-focusing) the beam sufficiently beyond the target plane to achieve a beam at the target plane with either uniform current density or a sharp edge. Again, Ohnishi discloses a first lens, second lens and an

aperture, but it clearly does not teach configuring them to create a shaped beam that is over-focused relative to the target plane and that has any of the desired characteristics as described by Applicant. Again, Applicant's background disclosure doesn't add anything except a mention that weak defocusing has been used in certain lithography applications. Therefore, the references fail to teach all of the recited limitations of claims 23 and 29 and thus cannot make them obvious.

Claims 24, 25, 27, and 30

Claims 24, 25, 27, and 30 stand rejected as obvious over Ohnishi in view of Applicant's background disclosure and Jones. Each of these claims ultimately depend from either claim 23 or claim 29 and thus are not obvious for the reasons set forth above. In addition, they recite various other features relating to an aperture with a straight edge, a rectangular aperture or placing a straight edge near the center of the beam. the Applicant uses Jones to teach these features, but as discussed above, Jones doesn't teach them and in fact, teaches away from them. The aperture of Jones is not part of the ion column for passing the beam there through but instead is part of the substrate serving as a form for etching away a field emitter with a desired shape. Thus, the cited references do not teach all of the features of these claims and do not make them obvious.

Conclusion

Applicant submits that all claims are now allowable and respectfully requests reconsideration and allowance of the application.

Respectfully submitted,

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